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**Role-playing game and learning for young people
about sustainable development stakes:
an experiment in transferring and adapting
interdisciplinary scientific knowledge**

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Context

Interdisciplinary research conducted on the theme of the environment often comes up against the complexity of functional processes, the absence of appropriate methods and the dissipation of skills and data in a field of study which is both vast and conducted in many different institutions. In addition, research whose objective is to contribute to sustainable development not only involves a systemic and interdisciplinary approach, but also requires empowerment of civil society stakeholders in acquiring knowledge and learning to speak the same language. For the collective action advocated by this concept is not limited to the scientific realm alone. It also involves finding synergies with local management policies and users and implies helping them in their steps by designing methods and tools and making them available. The objective is to promote the enhancement of goods and services of a territory to maintain local populations and ensure their well-being. The methodology must therefore be part of an interactive process during which stakeholders with diverging interests progressively construct a shared representation of reality, give it meaning and set objectives for themselves. For effective deliberation, these stakeholders must be able to access information and produce knowledge. Raising public awareness and education are also sought, so that individuals become aware of their own role in the ambitious political project that is sustainable development (Brodhag, 2004).

In the first phase, we examined the interactions between socio-economic and natural dynamics in an island biosphere reserve (Isle of Ouessant)¹ by using companion modelling (ComMod, 2005, 2006; d'Aquino *et al.*, 2001). In this framework, a conceptual model of the « Ouessant system » was constructed, forming the basis for developing a prototype using the CORMAS multi-agent platform (Cirad) (Rouan *et al.*, in press). It served as a basis for several scenarios used to explore trends in the environments and biodiversity, according to various socio-economic options (decline or increase of grazing, upkeep of coastal sward, etc.) (Kerbiriou, 2006; Gourmelon *et al.*, 2008). Concurrently, a role-play game piloted by the platform was begun to improve the model and make stakeholders aware of the dynamics underway² (Charles *et al.*, 2008; Chlous-Ducharme *et al.*, 2008). In the second phase, thought and discussion turned to transferring knowledge to the civil society³ by adapting research outputs to three operational contexts, in order to promote their being mastered and adopted by two types of public:

- multi-agent simulation as a management aid for a territory submitted to constraints and companion modelling to help in mediation (designed for managers),

¹ the *Organisation de l'accès aux ressources et biodiversité, application aux réserves de biosphère françaises* (IFB, 2003-2006) project coordinated by M. Etienne (INRA)

² supported by the Fondation de France

³ The *Modélisation multi-agents et jeu de rôles : des outils de médiation et d'apprentissage au service du développement durable (MEDIA)*, project supported by the *Appropriation sociale des Sciences* scheme of the Brittany regional council and the *Ingénierie écologique* programme of INEE-CNRS and Cémagref.

- role playing to help raise awareness and help young people learn about the stakes of sustainable development (designed for teachers).

This paper deals solely with the second aspect, devoted to transferring a role playing game created in a co-modelling experiment in a multi-agent environment towards an audience of school children.

Objectives

Educating younger generations is not only a priority for the French National education system, but for many other organisations, such as local authorities, scientific and technological culture centres, some programmes like Unesco's « Man and Biosphere » as well as environmental protection groups. In the context of the project, the goal was to introduce young people to interactions between social systems and ecological systems. It is assumed that a play-based approach will make young people aware of the environmental processes taking place on several temporal and spatial scales and develop their ability to apply the sustainable development concept. Since this is related to deliberations between diverse stakeholders, the game's objective is not just to promote the learning necessary for a dialogue that will not exclude those who are most lacking in either knowledge or skill, but which will also enable new standards and values to be acquired. In this context, the game, where Ouessant was taken as a model, should be adapted to a broader geographical frame (the coast) to raise public awareness about environmental issues and deliberation processes. Therefore, the proposed method must be flexible enough to be transposed to any coastal area; since the final objective is to ensure a transfer of tools which can be re-utilised in the educational realm without the scientists and independently of the initial site of application to raise the awareness of young generations about sustainable development.

Method

For the team in charge of this part of the study (the educational department of Océanopolis and relay advisers from the National education system), the first step is to become familiarised with the role-playing game and understand how it works. To this end, the team met several times to analyse the game proposed by the scientists, define how it could be incorporated into a broader educational project and supply any modifications needed. After analysing school curricula, it appeared that the game held educational interest for high school students in the fifth form (10th grade US) on several themes: the evolution of the environment considered as an area developed by human societies, the role of man and society in the development of these territories, the footprint of tourism and populations on coasts, the impact of human activities on coastal areas, the need for specific management and protection, the study of a relatively unpopulated coastal zone, the fragility of an ecosystem and interactions between humans and Earth's outer layers.

In order to assess whether students found it interesting, two test sessions were set up. On this basis, it was decided that the role-playing game would be part of an educational workshop on the coastal area theme proposed by Océanopolis for fifth-form students.

The educational workshop « Between land and sea, the coasts ».

It is based on three working sequences which take place at the Océanopolis ocean discovery park (Brest) under the leadership of a teacher or instructor: the role-playing game, the guided tour of Océanopolis's temperate pavilion and a « Summary outline » session. The content of this workshop ties in with:

- the fifth-form geography courses ("coastalisation" of activities, study of a seafront, development of tourism and recreational activities, urban development in coastal areas, changing landscapes, protection schemes);

- curricula for civics, legal and social subjects in high school (citizenship classes (using role-playing games), decision-making, speaking in a group, collective action and debating);
- the fifth-form Life and earth sciences curriculum (teaching sustainable development, relations between humans and animal species).

In terms of the methodological aims, role playing enables students to play an active part in their learning by experiencing it, and concretely set out the issues for the subject. Studying a local case (Iroise Sea) carries on from the school curricula, while broadening their outlook. The issues could be dealt with in part by finding information on the various exhibition displays in the temperate pavilion at Océanopolis. The summing up exercise can be provided as a sketch or outline, in compliance with official national education guidelines and with the perspective of final (A-levels) high school examinations.

- **role playing** aims to improve awareness and learning by school children and students about the stakes of sustainable development. Originally developed for adults playing their own role (knowledge about activities and the environment) and the objective of mediation, adapting it to this new context required various modifications, mainly as regards the game board, rules and computer interface.

To set the approach in a wider local frame, the game was de-contextualised. This led to modifying the game cards and adapting their content for a young audience. 8 roles out of 9 were kept: elected official, Nature park representative, cow breeder, restaurateur, president of the hunting society, turf cutter, second home owner and permanent resident.

A new game board was created by a plastic artist, taking account of comments from the educational service to make it more attractive (colours of board and squares, squares with holes for easier handling and shape and look of the playing pieces).

An IT application for the interface was developed and adapted to the workshop to make it easier for the facilitator to master. In the previous configuration, the facilitator keyed in the data in a special format and launched the simulation computation, then gave the results to the game master. The complexity and the computing time of these operations meant that several adults should be present. To transfer the game and make it easier to master, it was essential that the number and expertise of the people required to run the game be reduced. The scientific facilitator had to perform all these actions alone. A new, more user-friendly, interface was therefore set up, taking account of some constraints, i.e. simplifying the operations to be performed, checking the rules and being able to project the display interface. The system had to be robust, intuitive and simple to use. Employing a peripheral device like a touch pad lets the facilitator stay mobile and always present for the students. Simple ergonomics adapted to the touch pad stylus are proposed. In addition, a number of operations were created to optimise the handling and supervise the sessions by automatically verifying the game rules.

The same visual features as the game board are used on the graphic interface. A colour code for each stakeholder in the game was also implemented. After being used a few times, this interface enables the scientific facilitator to work alone and assume the game master's missions.

- To supplement the game, appropriate **teaching tools and documents** were also developed.

A film called « *Le littoral: support de démarche pluridisciplinaire et collective* » (the coast as medium for a collective, multidisciplinary approach) was designed by the scientists working in collaboration with the Océanopolis relay advisers. It shows students the interdisciplinary work done by researchers and opens the session.

An educational document drawn up for students lets them report on the different activities in the workshop and a file enables teachers to prepare their day at Océanopolis.

Conclusion

A multi-agent model devoted to interactions between social dynamics and natural dynamics on the isle of Ouessant was used as the medium for a role-playing game adapted to the school curriculum of fifth-form classes on the theme of sustainable development and coastal areas (History-Geography, Life and Earth Sciences and Civics). Adapting it required close collaboration between the scientists behind the project, the educational service at Océanopolis and teachers. Transferring the game required transforming both its substance and form, piloting it with an easy-to-handle ergonomic platform, support from scientists in presenting the approach to teachers and a film to introduce the game.

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